VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY HYDERABAD
B.TECH. II YEAR
(MECHANICAL ENGINEERING)

III SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19BS1MT10	Partial Differential Equations and Numerical Methods	3	0	0	3	3
19PC1ME01	Metallurgy and Materials Engineering	3	0	0	3	3
19PC1ME02	Manufacturing Processes	3	0	0	3	3
19PC1ME03	Fluid Mechanics and Machinery	3	0	0	3	3
19PC1ME04	Thermodynamics	3	1	0	4	4
19PC2ME01	Metallurgy and Materials Engineering Laboratory	0	0	2	2	1
19PC2ME02	Manufacturing Processes Laboratory	0	0	3	3	1.5
19PC2ME03	Fluid Mechanics and Machinery Laboratory	0	0	3	3	1.5
Total		**15**	**1**	**8**	**24**	**20**

IV SEMESTER **R19**

Course Code	Title of the Course	L	T	P/D	Contact Hours/ Week	Credits
19PC1ME05	Thermal Engineering	3	0	0	3	3
19PC1ME06	Kinematics of Machinery	3	1	0	4	4
19PC1ME07	Machine Tools and Metrology	3	0	0	3	3
19PC1ME08	Mechanics of Solids	3	0	0	3	3
19PC1ME09	Instrumentation and Control Systems	3	0	0	3	3
19PC2ME04	Thermal Engineering Laboratory	0	0	3	3	1.5
19PC2ME05	Machine Tools and Measurements Laboratory	0	0	3	3	1.5
19PC2ME06	Mechanics of Solids Laboratory	0	0	2	2	1
Total		**15**	**1**	**8**	**24**	**20**
19MN6HS02	Environmental Science	2	0	0	2	**0**

L – Lecture T – Tutorial P – Practical D – Drawing

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19BS1MT10) PARTIAL DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS
(Common to ME and AE)

COURSE PREREQUISITES: Differentiation, Integration

COURSE OBJECTIVES: Student will gain knowledge of
- Evaluation of Fourier coefficients
- Method of Separation of Variables to solve second order Partial Differential Equations
- Numerical methods to solve non-linear systems
- Various methods of interpolation and its application
- Concepts of numerical differentiation and integration

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Determine the Fourier series for periodic functions
CO-2: Solve the second order linear partial differential equations
CO-3: Apply numerical methods to find a root of algebraic and transcendental equations
CO-4: Find the interpolate value from the given set of data points
CO-5: Evaluate problems based on numerical differentiation, integration and numerical solutions of ordinary differential equations

UNIT – I:
Fourier Series: Introduction of Fourier Series, determination of Fourier coefficients, Fourier series in an arbitrary interval, Fourier series for even and odd functions, Half range sine and cosine series

UNIT – II:
Partial Differential Equations of Second Order: Classifications of Second Order Partial differential Equations, Method of separation of variables, Applications: Problems of vibrating string- wave equation, Problems of one-dimensional heat equation, Problems of steady state two dimensional heat flow-Laplace equation.

UNIT – III:
Solutions of Non-linear Systems: Introduction; Mathematical preliminaries; Solution of algebraic and transcendental equations–bisection method, the method of false position, Fixed point iterative method, Newton - Raphson method, and their order of convergence.

UNIT – IV:
Interpolation: Introduction; Errors in polynomial interpolation; Finite differences; Forward differences; Backward differences; Central differences; Symbolic relations and separation of symbols; Differences of a polynomial; Newton's formulae for interpolation; Central difference interpolation formulae; Gauss's central difference formulae and Lagrange's interpolation formulae.

UNIT – V:

Numerical Differentiation and Integration: Numerical differentiation based on interpolation, Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, and Simpson's 3/8 rule, Gaussian quadrature 2 & 3-point formulae.

UNIT – VI:

Numerical Solutions of Ordinary Differential Equations: Solution of initial value problems by Taylor's series - Picard's method of successive approximations, Euler's method, Modified Euler's method and Runge - Kutta methods.

TEXT BOOKS:

1. Higher Engineering Mathematics - B. V. Ramana, McGraw-Hill Publishers
2. Advanced Engineering Mathematics - Erwin Kreyszig, 8th Edition; John Wiley
3. Introductory Methods of Numerical Analysis - S. S. Sastry, PHI learning Pvt. Ltd

REFERENCES:

1. Advanced Engineering Mathematics - Peter 'O' Neil, Cengage Learning
2. Advanced Engineering Mathematics - R. K. Jain and S. R. K. Iyengar; Narosa Publication
3. Higher Engineering Mathematics - B. S. Grewal, Khanna Publishers, 36th Edition, 2010

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B.Tech. III Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1ME01) METALLURGY AND MATERIALS ENGINEERING
(Common to ME and AE)

COURSE PREREQUISITES: Physics and Chemistry

COURSE OBJECTIVES:

- To understand the microstructures of different types of metal and alloys –cast iron, steels, non-ferrous metal and alloys
- To understand the heat treatment principles-annealing, normalizing and hardening
- To understand the different types of tools
- To understand the importance of titanium & its alloys

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Distinguish different types of metals, solid solutions, alloys compounds and phases
CO-2: Design a heat treatment process to change the properties-hardness, ductility, etc.
CO-3: Analyze the characters and failure of metals and alloys
CO-4: Explain & justify the usage of composites in engineering field

UNIT – I:
Metal Structure and Crystallization: Introduction - atom binding, ionic bond, covalent bond, metallic bond, and Vander Waals forces; Crystal imperfections.
Overview of Metal Structure and Crystallization.
Constitution of Alloys: Introduction; Classification of alloys or compounds; Pure metal; Intermediate alloy phase or compound - intermetallic compounds or valency compounds, interstitial compounds, and electron compounds; Solid solutions; Substitution solid solution - factors that control the range of solubility in alloy system; Interstitial solid solutions.

UNIT – II:
Phase Diagrams: Introduction; Coordinates of phase diagrams; Experimental methods - construction of equilibrium diagrams by thermal analysis, metallographic methods, and X-ray diffraction; Type-I-Two metals completely soluble in the liquid and solid states; Chemical composition of phases; relative amounts of each phase; Equilibrium cooling of a solid solution alloy; Diffusion; Nonequilibrium cooling; Homogenization; Properties of solid-solution alloys; Variation of Type I; Type II-Two metals completely soluble in the liquid state and completely insoluble in the solid state; Type III-Two metals completely soluble in the liquid state but only partly soluble in the solid state; Properties of eutectic alloy systems; Age hardening – solution treatment, and aging process; Type IV-The congruent-melting intermediate phase; Type V-The peritectic reaction; **Type VI-Two liquids partly soluble in the liquid state:** the monotectic reaction; Type VII-two metals insoluble in the liquid and solid states; Interrelation of basic types;

UNIT – III:
The Heat Treatment of Steel: Introduction; Full Annealing; Spheroidizing; Stress-relief annealing; Process annealing; Normalizing; Hardening; The isothermal transformation

diagram; Cooling curves and I-T Diagram; Transformation on continuous cooling; Position of the I-T curves, Hardening or austenitizing temperature, Mechanism of heat removal during quenching - vapor-blanket cooling state (stage A), vapor transport cooling stage (stage B), Liquid cooling stage (stage C); Quenching medium; Temperature of quenching medium, Surface condition - methods to minimize the formation of scale - copper plating, protective atmosphere, liquid-salt pots, and cast-iron chips; Size and Mass, Hardenability; Use of Hardenability data; Tempering; Austempering; Surface heat treatment or case hardening; Carburizing; Heat treatment after carburizing; Cyaniding and Carbonitriding; Nitriding; Flame hardening; Induction Hardening.

UNIT – IV:

Alloy Steels: Introduction; Purpose of alloying; Effect of alloying elements upon Ferrite; Effect of alloying elements upon carbide; Influence of alloying elements on the iron-iron carbide diagram; Effect of alloying elements in tampering; Classification of steels - nickel steel, chromium steel, nickel-chromium steels, manganese steels, molybdenum steels, tungsten steels, vanadium steels, silicon steels, stainless steels, martensitic stainless steels, ferritic stainless steels, austenitic stainless steels, precipitation-hardening stainless steels, maraging steels, and ausforming.

Tool Steels: Classification of tool steels; Selection of tool steels; Comparative properties; Non-deforming properties; Depth of hardening; Toughness; Wear resistance; Red-hardness; Machinability; Resistance to decarburization; Brand names; Water-hardening tool steels (Group W); Shock resisting tool steels (Group S); Cold-work tool steels; Hot-work tool steels (Group H); High speed tool steels; Mold Steels (Group P); Special purpose tool steels; Heat treatment of tool steels; Overview of tool failures; Special cutting materials – satellites, cemented carbides, and ceramic tools.

UNIT – V:

Cast Iron: Introduction; Types of cast iron; White cast iron; Malleable cast iron; Pearlitic malleable iron; Gray cast iron; Silicon in cast iron; Sulfur in cast iron; Manganese in cast iron; Phosphorus in cast iron; Heat treatment of grey iron, Size and distribution of graphite flakes; Mechanical properties and applications of grey cast iron; Chilled cast iron; Nodular cast iron; Alloy cast irons.

Non-Ferrous Metals and Alloys: Introduction; Copper and its alloys - Copper, temper designation of copper and copper alloys, and copper alloys; Aluminum and its alloys - Aluminum, Alloy designation system, and temper designation; Titanium and Titanium alloys.

UNIT – VI:

Composites: Introduction, classification of composites-Fibre reinforced composites, Pertial reinforced composites, Dispersion strengthened metals, laminates; Advanced Fibre reinforced composites –Metal matrix composites, Ceramic –matrix composites, Carbon - Carbon composites, Hybrid composites; Fabrication of Fibre- reinforced composites-Hand lay –up process, Filament winding process, Sheet- moulding compound process, continuous pultrusion process, resin transfer moulding, vacuum-bag moulding.

TEXT BOOKS:

1. Introduction to Physical Metallurgy by Sidney H. Avner; McGraw-Hill
2. Materials Science and Metallurgy by Kodgire, Everest

REFERENCES:

1. Essentials of Materials Science and Engineering by Donald R. Askeland and Thomson
2. Materials Science and Engineering by William and Collister
3. Elements of Materials Science by V. Raghavan
4. Metallurgy and Material Science by Pakirappa

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. III Semester – ME & AME	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1ME02) MANUFACTURING PROCESSES

COURSE PREREQUISITES: Material science, Manufacturing Science.

COURSE OBJECTIVES:
- To understand about sand casting and metal casting techniques
- To impart the knowledge of various welding processes
- To evaluate the importance of rolling, forging and sheet metal operations
- To analyze the processing of plastics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze and select the suitable casting technique for making the components
CO-2: Analyze the different types of welding processes are needed for various materials and importance of welding
CO-3: Apply the methods involved in sheet metal operations, rolling, forging etc
CO-4: Apply the various manufacturing methods in processing of plastics

UNIT – I:
Casting: Steps involved in making a casting; Advantage of casting and its applications; Types of Foundry sands, Types of patterns – Materials used for patterns; Pattern allowances and their construction; Principles of Gating, Gating ratio and design of gating systems. Risers; Types; Casting design considerations;
Special casting processes: Centrifugal, Die, Investment casting only, Cupola furnace and Electric arc furnace only.

UNIT – II:
Welding: Classification of welding processes, types of welds and welded joints, Gas welding, ARC welding, Resistance welding, Thermit welding and Plasma welding. TIG & MIG welding, Friction stir welding, Explosive welding, Soldering & Brazing. Heat affected zones in welding; welding defects.

UNIT – III:
Mechanical Working -1: Hot working; Cold working; Strain hardening; Recovery; Recrystallisation and grain growth; Comparison of properties of cold and hot worked parts.
Rolling: Rolling fundamentals; Theory of rolling; Types of Rolling mills and products.

UNIT – IV:
Extrusion: Basic extrusion process and its characteristics; Hot extrusion and Cold extrusion; Forward extrusion and backward extrusion – Impact extrusion; Hydrostatic extrusion; Extrusion defects.
Forging Processes: Principles of Forging; Tools and dies; Types of Forging; Smith forging; Drop Forging; Roll Forging; Rotary Forging; Forging defects.

UNIT – V:

Mechanical Working -2: Stamping, forming and other cold working processes: Blanking and piercing; Bending and forming; Drawing and its types; Wire drawing and Tube drawing; Coining; Hot and cold spinning

UNIT – VI:

Plastic Materials and Processes: Types of plastics; advantages of plastics, Injection moulding; Blow moulding; Thermoforming. Compression moulding.

TEXT BOOKS:

1. Manufacturing Technology by P.N. Rao
2. Production Technology by R.K. Jain

REFERENCES:

1. Manufacturing Engineering and Technology by Kalpak Jian S
2. Process and Materials of Manufacturing by Lindberg/PE
3. Principles of Metal Castings by Rosenthal.
4. Welding Process by Parmar
5. Production Technology by Sharma P C

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B.Tech. III Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1ME03) FLUID MECHANICS AND MACHINERY
(Common to ME and AE)

COURSE OBJECTIVES:
- To understanding the properties of fluids, principles of buoyancy, flow, force and head calculations
- To evaluation of types of fluid flow, Laminar and dynamic
- To knowledge on boundary layer principles applied to airfoils
- To principles of operation of different types of hydraulic machinery
- To understanding Hydraulic systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyzing the fluid properties to solveflow, force and velocity problems
CO-2: Evaluating the flow characterizing in static and dynamic nature of flow
CO-3: Applying fluid flow and dynamics insolving problems in hydraulic machines
CO-4: Understanding the model analysis of hydraulic machinery and select appropriate machines for hydro power plant
CO-5: Analyzing the hydraulic systems

UNIT – I:
Fluid Statics: Properties of fluid – specific gravity, viscosity, surface tension, vapor pressure and their influence on fluid motion, Pressure at a point, measurement of pressure, Forces on immersed surfaces, Center of pressure, Buoyancy, Elements of stability of floating and submerged bodies.

UNIT – II:
Fluid Kinematics: Introduction, methods of describing the fluid motion, Classification of flows, acceleration equations, Stream line, path line and streak lines and stream tube, continuity equation, Stream function, velocity potential function, introduction to free and forced vortex flows.

UNIT – III:
Fluid Dynamics: Surface and body forces – Euler's and Bernoulli's equation, Venturimeter, Orifice meter, Pitot tube, Reynolds experiment –Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel. Momentum equation, force on pipe bends.

UNIT – IV:
Boundary Layer Theory: Development of boundary layer along a thin flat plate, laminar boundary layer and turbulent boundary layer, Laminar sub layer, boundary layer separation, Drag and lift forces - Aero foils, pressure and form drags.
Impact of Jets: Hydrodynamic force of jets on flat, inclined and curved vanes - jet striking centrally and at tip, flow over radial vanes.

UNIT – V:

Hydraulic Turbines: Classification of turbines, design of Pelton wheel, Francis turbine and Kaplan turbine – working proportion, work done, efficiency, draft tube- theory, functions and efficiency. Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank and water hammer, elements of hydropower plant.

UNIT – VI:

Hydraulic Pumps: Classification, centrifugal pumps – types, working, work done, monomeric head, losses and efficiency, specific speed – pumps in series and parallel – performance characteristic curves, NPSH, Reciprocating Pump – types, Working, Discharge, slip, indicator diagrams

TEXT BOOKS:

1. Hydraulics and Fluid Mechanics Including Hydraulics Machines: P. N. Modi, S. M. Seth
2. Introduction to Fluid Mechanics: R. W. Fox, A. T. McDonald and P. J. Pritchard

REFERENCES:

1. Fluid Mechanics: V. L. Streeter & E. B. Wylie
2. Fluid Mechanics, Fundamentals & Applications: Yunus A. Çengel, John M. Cimbala
3. Fluid Mechanics: F. M. White
4. Fundamentals of Fluid Mechanics: Bruce Roy Munson, Donald F. Young, Theodore H. Okiishi, Wade W. Huebsch, Wiley Publication

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B.Tech. III Semester	**L**	**T/P/D**	**C**
	3	**1**	**4**

(19PC1ME04) THERMODYNAMICS

COURSE PREREQUISITES: Physics, Mathematics

COURSE OBJECTIVES:

- To apply the basic concepts of thermodynamics, heat and work done on the system
- To apply the basic concepts of Thermodynamic Laws for various thermodynamic systems
- To evaluate the properties of pure substance and to analyse the concept of irreversibility and availability
- To apply the basic concept of power cycles for External combustion engines and internal combustion engines
- To evaluate the behaviour of ideal gas mixtures and thermodynamic properties

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: To apply the basic concepts of thermodynamics, heat and work done on the system

CO-2: To apply the basic concepts of thermodynamic laws for various thermodynamic systems

CO-3: To evaluate the properties of pure substance and to analyse the concept of irreversibility and availability

CO-4: To apply the basic concept of power cycles for external combustion engines and internal combustion engines

CO-5: To evaluate the behaviour of ideal gas mixtures and thermodynamic properties

UNIT – I:

Concepts and Definitions: Thermodynamic system and control volume; Macroscopic versus microscopic point of view; Properties and state of a substance; Processes and cycles, Energy, Specific volume and density, Equality of temperature; The Zeroth law of thermodynamics; Temperature scales.

Work and Heat: Definition of work; Units for work; Work done at the moving boundary of a simple compressible system; Other systems that involve work; Definition of heat; Heat transfer modes; Comparison of heat and work.

UNIT – II:

The First Law of Thermodynamics: The first law of thermodynamics for a control mass undergoing a cycle; The first law of thermodynamics for a change in state of a control mass; Internal energy-a thermodynamic property; Problem analysis and solution technique; Enthalpy; The constant-volume and constant-pressure specific heats; The internal energy, enthalpy, and specific heat of ideal gases; The first law as a rate equation.

First Law Analysis for a Control Volume: Conversion of mass and the control volume, the first law of thermodynamics for a control volume, The steady-state process; Examples of steady-state processes.

UNIT – III:

The Second Law of Thermodynamics: Heat engines and refrigerators; The second law of thermodynamics; The reversible process; Factors that render processes irreversible; The Carnot cycle; Two propositions regarding the efficiency of a Carnot cycle; The thermodynamic temperature scale; The ideal-gas temperature scale; Ideal versus real machines.

Entropy for a Control Mass: The inequality of Clausius; Entropy — a property of a system; The entropy of a pure substance; Entropy change in reversible processes; The thermodynamic property relation; Entropy change of an ideal gas; The reversible polytropic process for an ideal gas; Entropy change of a control mass during an irreversible process; Entropy generation; Principle of increase of entropy; Entropy as a rate equation.

UNIT – IV :

Irreversibility and Availability: Available energy; Available energy Referred to a cycle; Quality of energy; Maximum work in a reversible process; reversible work by an open system; Exchanging heat only with the surroundings; Useful work; Dead state; Availability; Availability in chemical reaction; Irreversibility and Gouy-stodola Theorem; Availability or Exergy Balance; second law efficiency;

Properties of a Pure Substance: The pure substance; Vapor- liquid- solid- phase equilibrium in a pure substance; Independent properties of a pure substance; Steam Tables; Thermodynamic surfaces; The compressibility factor; Equations of state.

UNIT – V:

Power Cycles: Introduction to power systems; The Rankine cycle; Effect of pressure and temperature on the Rankine cycle; Air-standard power cycles; Basic Brayton cycle; The air-standard cycle for jet propulsion; Reciprocating engine power cycles; The Otto cycle; The Diesel cycle; The Dual cycle, The Stirling cycle; The Atkinson and Miller cycles.

UNIT – VI:

Properties of Gases and Gas Mixtures: Avogadro's Law; Ideal Gas; Equation of State; Law of Corresponding; Properties of Mixture of Gases-Dalton's Law of Partial Pressures; Internal Energy, Enthalpy, and Specific Heats of Gas Mixtures; Entropy of Gas Mixtures; Gibbs Function of a Mixture of Inert ideal Gas; Thermodynamic Property Relations: Mathematical relations for a homogeneous phase; The Maxwell relations; Thermodynamic relations involving enthalpy, internal energy,
and entropy; The Clapeyron equation; Joule-Thompson coefficient.

TEXT BOOKS:

1. Engineering Thermodynamics by P. K. Nag, McGraw-Hill
2. Fundamentals of Thermodynamics by C. Borgnakke, R. E. Sonntag, and G. J. Van Wylen; John Wiley

REFERENCES:

1. Engineering Thermodynamics by Burgadt, Harper & Row Publication
2. Thermodynamics — An Engineering Approach by Yunus Cengel and Boles; TMH
3. Engineering Thermodynamics by P. Chattopadhyay, Oxford University Press

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B.Tech. III Semester	**L**	**T/P/D**	**C**
	0	**2**	**1**

(19PC2ME01) METALLURGY AND MATERIALS ENGINEERING LABORATORY

COURSE PREREQUISITES: Metallurgy and Material Science

COURSE OBJECTIVES:

- To understand the significance of microstructure of non ferrous materials under microscopic testing
- To understand the changes in microstructures after different heat treatments processes
- To understand the significance of microstructure of ferrous materials under microscopic testing
- To understand the changes processes of testing for different materials

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Test and Identify different microstructures of various materials

CO-2: Prepare appropriate heat treatment for a given material by checking its microstructure

CO-3: Conduct mechanical test on ferrous and non ferrous materials for mechanical properties

CO-4: Able to identify and analyze various mechanical properties for different mechanical applications

METALLURGY LABORATORY

1. Preparation and study of the microstructure of metals like Iron, Cu and Al.
2. Preparation and study of the microstructure of mildsteels, lowcarbon steels, and high carbon steels.
3. Study of the microstructures of cast irons.
4. Study of the microstructures of non-ferrous alloys.
5. Study of the micro structures of heat treat edsteels.
6. Hardenability of steels by Jominyend quench test.
7. Study the micro structure of cutting tools.
8. Study the micro structures of stainless steel.
9. Study and test the mechanical properties of cutting tools.
10. Comparing the mechanical properties through micro structure of weld metals
11. Study of different micro structures under various stresses

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B.Tech. III Semester	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

(19PC2ME02) MANUFACTURING PROCESSES LABORATORY

COURSE PREREQUISITES: Production Technology

COURSE OBJECTIVES:
- To understand and evaluate casting techniques and sand properties
- To understand different welding processes and their use
- To understand different press working operations
- To understand about the processing of plastics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the knowledge involved in casting techniques
CO-2: Decide the selection of various welding techniques applicable for different materials
CO-3: Integrate the knowledge involved in press working operations
CO-4: Analyze the techniques involved in processing of plastics

10 Exercises to be performed from the following:

I. Metal Casting:
1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - Exercise -for strengths, and permeability – 2Exercise
3. Moulding, Melting and Casting - 1 Exercise

II. Welding:
1. Arc Welding Lap and Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise
4. MIG Welding - 1 Exercise
5. Brazing - 1 Exercise

III. Mechanical Press Working:
1. Blanking and Piercing operation s.
2. Bending operation

IV. Processing of Plastics:
1. Injection Molding
2. Blow molding

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B.Tech. III Semester	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

(19PC2ME03) FLUID MECHANICS AND MACHINERY LABORATORY
(Common to ME and AE)

COURSE PREREQUISITES: Fluid Mechanics and Hydraulic Machines

COURSE OBJECTIVES:
- To analyzing the experiments to understand the concept, find the values and obtain the result of experiments
- To apply fundamental principles of fluid mechanics for the solution of practical mechanical engineering problems of water conveyance in pipes, orifices, mouth pieces, notches & weirs
- To analyzing various pumps, water turbines, pipes and pressure measurement devices
- To evaluating efficiency for pumps and turbines

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply fundamental equations of fluid mechanics for turbines and pumps
CO-2: Model and analyse fluid flow problems in mechanical engineering
CO-3: Create a model of fluid flow equipments
CO-4: Evaluate the experimental results with theoretical concepts

LIST OF EXPERIMENTS:

ANY 10 EXPERIMENTS to be conducted from the following:
1. Verification of Bernoulli's theorem
2. Calibration of Venturimeter/ Orifice meter.
3. Calibration of notches.
4. Determination of friction factor for a given pipe.
5. Determination of Minor losses for the given equipment
6. Impact of jet on vanes.
7. Performance test on Pelton wheel.
8. Performance test on Francis turbine.
9. Performance test on Kaplan turbine.
10. Performance test on single stage centrifugal pump.
11. Performance test on multi stage centrifugal pump.
12. Performance test on reciprocating pump.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

B.Tech. IV Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1ME05) THERMAL ENGINEERING

COURSE PREREQUISITE: Mathematics, Thermodynamics

COURSE OBJECTIVES:
- To analyse the actual cycles and systems of Internal Combustion Engine
- To analyse the combustion phenomena in Spark Ignition and Compression Ignition Engines
- To evaluate the performance parameters of internal combustion engines
- To analyse working and the performance of reciprocating compressor
- To evaluate the COP of different refrigeration cycles and to measure the psychrometric properties of air-conditioning system

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyse the actual cycles and compare it with the air standard cycle of the given engine
CO-2: Analyse the combustion phenomena in Spark Ignition and Compression ignition engines
CO-3: Evaluate the performance parameters (Brake power, Friction power, Torque, Efficiencies) of internal combustion engines
CO-4: Analyse working and the performance of (Isothermal efficiency, volumetric efficiency) reciprocating compressor
CO-5: Evaluate the COP of different refrigeration cycles and to measure the psychrometric properties of air

UNIT – I:
Actual Cycles and Their Analysis: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust blow down, Loss due to Gas exchange process, Volumetric Efficiency, Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of I.C. Engines.

UNIT – II:
I. C. Engines: Classification, Working principles, Valve and Port Timing Diagrams, Air Standard, air-fuel and actual cycles, Engine systems; Fuel Systems, Simple Carburetor, Solex Carburetor, Fuel Injection Systems; Ignition systems, Battery ignition, Magneto ignition, Cooling and Lubrication systems.

UNIT – III:
Combustion in S. I. Engines: Homogeneous mixture, Heterogeneous mixture, Stages of combustion, Flame front propagation, Factors influencing the flame speed, Rate of pressure rise, Abnormal combustion, Phenomenon of Knock, Types of Combustion chambers, Fuel requirements and fuel rating
Combustion in C. I. Engines: Combustion process, stages of combustion, Delay period and its importance, Factors affecting Delay period, Diesel Knock, Comparison of Knock in C.I and S.I engine, Combustion chambers in C.I. Engine, Fuel requirements and fuel rating.

UNIT – IV:

Testing and Performance: Measurement and Testing; Friction power, Indicated power, Brake power, Fuel consumption, Air consumption, Emissions Performance parameters; Engine power, Engine efficiencies, Engine performance characteristics, Heat Balance.

UNIT – V:

Reciprocating Air Compressors: Classification; Reciprocating Compressor: Principle of operation, Work required, Isothermal efficiency, Volumetric efficiency and effect of clearance, Multi stage compression with inter cooling, Saving of work, Minimum work condition for stage compression.

UNIT – VI:

Introduction to Refrigeration Cycle and Psychrometric Properties: Ideal Refrigeration cycles - Vapor compression refrigeration cycle, Bell Colman refrigeration cycle, Vapour Absorption Refrigeration System

Psychrometric properties - Dry bulb temperature, Wet bulb temperature, Dew point temperature, Specific humidity, Relative humidity, Degree of saturation, Specific enthalpy, Psychrometric chart, (Indicating only Psychrometric processes on Chart)

TEXT BOOKS:

1. I. C. Engines by V. Ganesan; Tata McGraw-Hill
2. Thermal Engineering by Mahesh M. Rathore; Tata McGraw-Hill

REFERENCES:

1. Refrigeration & Air Conditioning by C. P. Arora; Tata McGraw-Hill
2. I.C. Engines by Heywood; Tata McGraw-Hill
3. Thermal Engineering by Rajput; Lakshmi Publication

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	3	**1**	**4**

(19PC1ME06) KINEMATICS OF MACHINERY

COURSE PREREQUISITES: Geometrical Construction, Engineering Mechanics

COURSE OBJECTIVES:
- To understand mechanisms for motion transmission
- To understand the construction methods for drawing velocity and acceleration diagrams
- To design engineering applications involving in selection, sizing of mechanism to accomplish motion objectives
- To understand the mechanism involving cams, gears and gear trains

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Draw velocity and acceleration diagrams of various parts of a machine along with the transmission Mechanisms
CO-2: Design components of machine parts, structures, gears, cams, belts, pulleys, etc. for kinematic analysis
CO-3: Understand the straight line motion mechanisms, Hooke's joint and steering mechanisms
CO-4: Design the mechanisms after analysis for safety and efficient working

UNIT – I:
Mechanisms and Machines: Elements or links-classification-rigid link, flexible and fluid link-types of kinematic pairs-sliding pairs, turning, rolling, screw and spherical pairs-lower and higher pairs-closed and open pairs-constrained motion-completely, partially or successfully constrained and incompletely constrained.
Mechanisms, Machines -classification of machines- kinematic chain-inversion of mechanism-inversions of quadric cycle chain, single and double slider crank chains, Intermittent motion mechanisms.

UNIT – II:
Kinematics: Velocity and acceleration-motion of link in machine-Construction of velocity and acceleration diagrams-graphical method- Application of relative velocity method- four bar chain.
Analysis of Mechanisms: Analysis of slider crank chain for displacement, velocity and acceleration of slider- acceleration diagram for a given mechanism, Klein's construction, Coriolis acceleration, determination of Coriolis component of acceleration.
Plane Motion of Body: Instantaneous center of rotation, centroids and axodes - relative motion between two bodies-Three centers in line theorem-Graphical determination of instantaneous centre,analysis of simple mechanisms and determination of linear velocity and angular velocity of links.

UNIT – III:
Mechanisms and Hooke's Joint: Condition for correct steering –Davis steering gear, Ackerman's steering gear-velocity -ratio - Single and double Hooke's Joint- Universal coupling-applications- problems.

Straight Line Motion Mechanisms: Exact and approximate-copied and generated types - Peaucellier, Hart and Scott Russell- Grasshopper- Watt-Tchebicheff and Robert mechanism and straight line motion, Pantograph.

UNIT – IV:

Cams: Definition of cam and followers-their uses-types of followers and cams-terminology-types of follower motion-uniform velocity-simple harmonic motion and uniform acceleration, maximum velocity and acceleration during outward and return strokes in the above three cases. Overview of polynomial motions, Analysis of motion of followers: roller follower- circular cam with straight, concave and convex flanks.

UNIT – V:

Higher Pairs: Friction wheels and toothed gears-types-law of gearing, condition for constant velocity ratio for transmission of motion, forms of teeth- Cycloidal and Involute profiles. Velocity of sliding-phenomena of interference-methods of interference, condition for minimum number of teeth to avoid interference, expression for arc of contact and path of contact- introduction to helical, bevel and worm gearing, Central distance for a pair of spiral gears. Efficiency of spiral gears.

UNIT – VI:

Gear Trains: Introduction-train value-types-simple, compound and reverted wheel trains – epicyclic gear train, methods of finding train value or velocity ratio-selection and determination of torque, differential gear box for an automobile.

TEXT BOOKS:

1. Theory of Machines by Thomas Bevan
2. Theory of Machines by Rattan

REFERENCES:

1. Theory of Machines by P. L. Ballaney
2. Theory of Machines by R. S. Khurmi & J. K. Gupta
3. Theory of Machines by Sadhu Singh
4. Theory of Machines by Shigley
5. Mechanism and Machine Theory by J. S. Rao and R. V. Dukkipati

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1ME07) MACHINE TOOLS AND METROLOGY

COURSE PREREQUISITES: Production Technology and Engineering Materials

COURSE OBJECTIVES:
- To understand about the importance of metal cutting and cutting tools
- To understand different types of machine tools and the operations
- To learn about broaching, gear cutting, metal finishing processes
- To learn the measurement standards and methods of measurement

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Acquire basic knowledge on metal cutting, tools and the type of cutting tool materials in machining
CO-2: Understand various types of machine tools, principles and the operations performed
CO-3: Knowledge of broaching, gear cutting and finishing opearations- grinding and super finishing operations
CO-4: Understand the measurement principles and methods

MACHINE TOOLS
UNIT – I:
Introduction: Material removal processes, Types of Machine Tools; Types of cutting tools (Single and multi-point) and Nomenclature of Single point cutting tools.
Metal Cutting: Chip Formation, Shear Zone, Orthogonal & oblique Cutting, Merchant circle diagram (construction only), Tool Wear and Tool Life; Surface Finish; types of Cutting Tool Materials.

UNIT – II:
Machine tools:
Centre Lathe: Constructional Features of a Centre Lathe, Cutting Tools, Operations Performed in a Centre Lathe.
Special Purpose Lathes: Limitations of a Centre Lathe, Capstan and Turret Lathes-construction and differences.

UNIT – III:
Milling: Types of Milling Machines, Milling Cutters and Milling Operations.
Hole Making Operations: Types of hole making operations (basic),
Drilling: Twist drill geometry; Types of drills; Drilling machine types
BORING- principle and types of boring machines- horizontal boring and Jig boring machines
Reciprocating Machine Tools: Introduction of Shaper, Slotter and Planer

UNIT – IV:
Other Machine Tools:
Broaching- principle and types of broaching: Gear Cutting methods(basics), Gear Hobbing (principle & operation)

Grinding & Superfinishing Processes: Grinding: Principle of grinding; Types of Grinding Machines- Cylindrical grinding, Centerless Grinding & Surface Grinding processes;
Superfinishing: Basics of Honing, Lapping and Superfinishing.

METROLOGY
UNIT – V:
Systems of Limits and Fits: Introduction, normal size, tolerance limits, deviations, allowance, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly.
Linear Measurement: Limit Gauges; Go and No go gauges- plug, ring, snap, gap, taper, profile position gauges and slip gauges;
Angular Measurement: sine bar, spirit level, angle slip gages and sine plate.

UNIT – VI:
Screw Thread Measurement: Elements of measurement; Measurement of- effective diameter, angle of thread and thread pitch.
Gear Measurement: Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch pressure angle and tooth thickness
Optical Measuring Instruments: Tool maker's microscope and its uses; optical projector
Surface Roughness Measurement: Differences between surface roughness and surface waviness; Numerical assessment of surface finish – CLA, R.M.S Values, Rz values; Measurement of surface finish.

TEXT BOOKS:

1. Manufacturing Technology, Vol. 2, Metal Cutting and Machine Tools by P N Rao; Publisher: Tata McGraw Hill
2. Engineering Metrology by R.K. Jain; Publisher: Khanna
3. Engineering Metrology by I C Gupta; Publisher: Dhanpat Rai

REFERENCES:

1. Manufacturing Engineering and Technology by Serope Kalpak Jian; Publisher: Pearson Learning
2. A textbook of Manufacturing Technology (Manufacturing Processes), Laxmi Publications, by R K Rajput
3. Fundamentals of Modern Manufacturing by Mikell P. Groover
4. Production Technology by R. K. Jain & S. C. Gupta
5. BIS standards on Limits and Fits, Surface Finish, Machine Tool Alignment etc

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1ME08) MECHANICS OF SOLIDS

COURSE PREREQUISITES: Mathematics, Physics and Engineering Mechanics

COURSE OBJECTIVES:
- To list and define the Material properties and show the relationships between them
- To describe principles of Mechanics, Stress and Strain
- To demonstrate throughly the concepts of principal stresses applied to solid structural members and mohr's circle diagram
- To analyse various types of mechanical engineering problems concern to bending of beams, torsion of shafts etc

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Show basic stress strain equations with appropriate assumptions
CO-2: Interpret model and analyze solid mechanics problems on bars, beams and shafts
CO-3: Apply the concepts of principal stresses in real life design issues
CO-4: Analyse and develop beams, shafts for various applications

UNIT – I:
Tension, Compression, and Shear: Introduction; Normal Stress and Strain; Stress-strain diagrams; Elasticity and plasticity; Linear elasticity and Hooke's law; Allowable stress and allowable loads.
Axially Loaded Members: Introduction; Deflections of axially loaded members; Strain energy; Dynamic loading.

Thermal Stresses

UNIT – II:
Shear Force and Bending Moment Diagrams: Types of beams; Types of loading; Shear force and bending moment; Relationship between load, shear force and bending moment; Shear force and bending moment diagrams.

UNIT – III:
Area Moment of Inertia of Composite Sections:
Stresses in Beams: Introduction; Normal strains in beams; Normal stresses in beams; Cross-sectional shapes of beams-C, angular and semicircle structures; Shear stresses in rectangular beams; Shear stress in webs of beams with flanges; Shear stress in circular beams (solid and hollow sections); Concept of shear center and shear flow.

UNIT – IV:
Analysis of Stress and Strain: Introduction; Plane stress; Principal stresses and maximum shear stresses; Mohr's circle for plane stress; Hooke's law for plane stress; Spherical and cylindrical pressure vessels (biaxial stress; Hoop and longitudinal stresses); Combined loadings (plane stress); Principal stresses in beams.

UNIT – V:

Deflections of Beams: Introduction; Differential equations of the deflection curve; Deflections by integration of the bending moment equation; Deflections by integration of the shear-force and load equations; Macaulay's method; Moment area method; Method of superposition.

UNIT – VI:

Columns: Short columns, Euler's theory for axially loaded elastic long columns, Effective length, Limitations of Euler's Theory, Rankine's formula

Torsion: Introduction; Torsion of circular bars; Non uniform torsion; Pure shear; Relationship between modulus of elasticity E and *G*; Transmission of power by circular shafts.

TEXT BOOKS:

1. Mechanics of Materials (SI units) by Gere, J. M., Goodno, B. J, Cengage Learning, 2012
2. Strength of Materials by S. S. Rattan, Publisher: Tata McGraw-Hill Education, 2nd Edition, 2011

REFERENCES:

1. Engineering Mechanics of Solids by Popov E.P Prentice Hall of India Private Limited, 2004
2. Mechanics of materials by Beer F.P., Johnson E.R., and DeWolf, J.T. Tata McGraw-Hill, 2004
3. Strength of Materials by Schaum's Series, Mcgraw-Hill Book Company, 6th Edition

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	3	**0**	**3**

(19PC1ME09) INSTRUMENTATION AND CONTROL SYSTEMS

COURSE PREREQUISITES: Metrology

COURSE OBJECTIVES:

- To provide basic knowledge in transduction principles, sensors and transducer technology and measurement systems
- To provide better familiarity with the Theoretical and Practical concepts of automation in industries
- To provide familiarity with different sensors and their application in real time applications
- To provide the knowledge of various measurement methods of industrial parameters like velocity, acceleration, torque, pressure, flow, temperature etc. and control of the same

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Know instrumentation system used in the industry
CO-2: Appreciate the automation with the help of instrumentation
CO-3: Understand the experimental applications and selecting appropriate engineering modules
CO-4: Develop aptitude for self-learning and modern technical skills beyond the curriculum

UNIT – I:
Definition: Basic principles of measurement - Measurement systems, generalized configuration and functional descriptions of measuring instruments - examples. Dynamic performance characteristics - sources of error, Classification and elimination of error,

UNIT – II:
Measurement of Displacement: Theory and construction of various transducers to measure displacement - Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers, Calibration procedures.
Measurement of Temperature:
Classification - Ranges - Various Principles of measurement - Expansion, Electrical Resistance - Thermistor - Thermocouple - Pyrometers - Temperature Indicators.

UNIT – III:
Measurement of Pressure: Units - classification - different principles used. Manometers, Piston, Bourdon pressure gauges, Bellow - Diaphragm gauges. Low pressure measurement - Thermal conductivity gauges - ionization pressure gauges, Mcleod pressure gauge.
Measurement of Level: Direct method - Indirect methods capacitive, ultrasonic, magnetic, cryogenic fuel level indicators - Bubble level indicators.
Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow mete Hot - wire anemometer, Laser Doppler Anemometer (LDA) .

UNIT – IV:

Measurement of Speed: Mechanical Tachometers Electric tachometers - Stroboscope, Non- contact type of tachometer. Measurement of Acceleration and Vibration: Different simple instruments - Principles of Seismic instruments - Vibrometer an accelerometer using this principle.

Stress Strain Measurements: Various types of stress an strain measurements - electrical strain gauge - gauge factor - method of usage of resistance strain gauge for bending compressive and tens) strains - usage for measuring torque, Strain gauge Rosettes.

UNIT – V:

Measurement of Humidity: Moisture content of gases, all psychrometer, Absorption psychrometer, Dew point meter Measurement of Force, Torque And Power: Elastic force meters, lo cells, Torsion meters, Dynamometers.

UNIT – VI:

Elements of Control Systems: Introduction, Importance -Classification - Open and closed systems Servomechanisms Examples with block diagrams - Temperature, speed and position control systems.

TEXT BOOKS:

1. Measurement Systems: Applications & Design by D. S. Kumar, Anuradha Agencies
2. Instrumentation, Measurement & Analysis by B. C. Nakra & K. K. Choudhary, TMH

REFERENCES:

1. Instrumentation and Control Systems by S. Bhaskar, Anuradha Agencies
2. Experimental Methods for Engineers by Holman, McGraw-Hill Education
3. Mechanical and Industrial Measurements by R. K. Jain, Khanna Publishers
4. Mechanical Measurements by Sirohi and Radhakrishna, New Age
5. Instrumentation & Mechanical Measurements by A. K. Tayal, Galgotia Publications

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

(19PC2ME04) THERMAL ENGINEERING LABORATORY

COURSE PREREQUISITES: Thermodynamics, Thermal Engineering

COURSE OBJECTIVES:

- To measure the performance parameters and draw its characteristic curve for a diesel engine
- To measure the performance parameters and draw its characteristic curve for a petrol engine
- To measure the performance parameters of reciprocating compressor
- To evaluate the COP of refrigeration and Air conditioning system

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: To measure the Performance parameters like Brake Power, Indicated Power, friction power, specific fuel consumption, volume flow rate of air into the engine cylinder and specific heat of the exhaust gases and to calculate the various heat losses in the engine

CO-2: To measure the Performance parameters like Brake Power, Indicated Power, friction power, specific fuel consumption, volume flow rate of air into the cylinder and specific heat of the exhaust gases and draw its characteristic curve for a petrol engine

CO-3: To measure the Performance parameters of reciprocating compressor like mass flow rate of air in the compressor, power consumed by the compressor, volumetric efficiency and Isothermal efficiency

CO-4: To evaluate the COP of refrigeration system based on the experimental value as well as the P-H chart and to evaluate COP Air conditioning system based on the experimental value and by using the Psychrometric chart for air

LIST OF EXPERIMENTS:

Any 10 experiments to be conducted from the following:

1. Valve Timing Diagram on Single Cylinder Four Stroke Diesel Engine.
2. Port Timing Diagrams on Single Cylinder Two Stroke Petrol Engine.
3. Performance Test on Single Cylinder Four Stroke Diesel Engine.
4. Heat Balance Test on Single Cylinder Four Stroke Diesel Engine.
5. Measurement of Optimum Cooling Water Temperature on Single Cylinder Four Stroke Diesel Engine.
6. Performance Test on Four Stroke Twin Cylinder Diesel Engine.
7. Performance Test on Four Stroke Multi Cylinder Petrol Engine.
8. Heat Balance Test on Four Stroke Multi Cylinder Petrol Engine.
9. Measurement of Air/Fuel Ratio and Volumetric Efficiency on Multi Cylinder Four Stroke Petrol Engine.
10. Evaluation of Engine Friction by Conducting Morse Test on Four Stroke Multi Cylinder Petrol Engine.
11. Performance Test on Single Cylinder Two Stroke Petrol Engine.
12. Performance Test on Reciprocating Air – Compressor Test Rig.
13. Performance Test on Air Conditioning Test Rig.
14. Performance Test on Refrigeration Test Rig.
15. Dis-assembly / Assembly of I.C Engines.

16. Performance Test on Computerized Diesel Engine.

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	0	**3**	**1.5**

(19PC2ME05) MACHINE TOOLS AND MEASUREMENTS LABORATORY

COURSE PREREQUISITE: Machine tools, Metrology and Engineering Materials

Course Objectives:
- To learn the principles of various machine tools and their accessories
- To learn to grind the cutting tools on tool and cutter grinder
- To know various methods of measurements
- To know the thread profile and surface rougness profile measurement

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Perform operations on different Machine tools
CO-2: Knowledge of tool grinding using tool and cutter grinder
CO-3: Knowledge of different methods of Measurements in different machining operations
CO-4: Analyze the thread profile and surface roughness profile

MACHINE TOOLS: Any FIVE experiments from the following
1. Exercise on Facing, turning, step turning and taper turning on lathe machine
2. Exercise on Grooving, Thread cutting and knurling on lathe machine.
3. Exercise on Drilling, Counter sinking and Tapping operations on drilling machine
4. Exercise on Shaping to prepare plain surfaces
5. Exercise on Slotting to prepare keyway slot (internal/ external)
6. Exercise on Milling to perform plain /gear cutting
7. Exercise on Grinding of Tool angles.
8. Exercise on Cylindrical Surface Grinding

METROLOGY: Any FIVE experiments from the following
1. Measurement of lengths, heights, diameters by vernier calipers micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, Vernier calipers and checking the chordal addendum and chordal height of spur gear.
4. Use of spirit level in finding the flatness of surface plate.
5. Thread measurement by two wire/ three wire method or tool makers' microscope.
6. Tool makers microscope and its application
7. Angle and taper measurements by bevel protractor, sine bars, etc.
8. Surface roughness measurement
9. Machine tool alignment test on a lathe.
10. Machine tool alignment test on a milling machine.
11. Surface wear resistances test using electro spark coating device.

REFERENCES:

1. Workshop Technology by W.A.J. Chapman (Parts I, II, and III); Publisher: Viva Books.
2. The Principles of Metallographic Laboratory Practice by George L. Kehl; Publisher: McGraw Hill.

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	0	**2**	**1**

(19PC2ME06) MECHANICS OF SOLIDS LABORATORY

COURSE PREREQUISITES: Engineering Mechanics, Mechanics of Solids

COURSE OBJECTIVES:
- To analyze the various tests to be conducted on engineering materials
- To the significance of tests in evaluating the corresponding mechanical properties
- To analyze the importance of technical parameters used during tests
- To applying the concepts learned in the real time

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply the theoretical concepts by conducting the tests on different materials
CO-2: Evaluate the result of test and comment on the mechanical properties of materials
CO-3: Decide a material and an appropriate test suitable for given application
CO-4: Analyze the significance of the tests in different fields of engineering

LIST OF EXPERIMENTS:
1. Direct tension test
2. Bending test on simply supported beam
3. Bending test on cantilever beam
4. Torsion test
5. Brinell hardness test
6. Rockwell hardness test
7. Test on close coiled helical spring
8. Compression test on a cube
9. Charpy Impact test
10. zod Impact test
11. Direct shear test
12. Mechanical advantage of simple screw jack
13. Moment of Inertia of a fly wheel

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B.Tech. IV Semester	**L**	**T/P/D**	**C**
	0	**2**	**0**

(19MN6HS02) ENVIRONMENTAL SCIENCE

COURSE PREREQUISITES: Basic knowledge of environmental issues

COURSE DESCRIPTION:
Environmental science is the study of patterns and processes in the natural world and their modification by human activity. We as human beings are not an entity, separate from the environment around us, rather we are a constituent seamlessly integrated and co-exist with the environment around us. To understand current environmental problems, we need to consider physical, biological and chemical processes that are often the basis of those problems. The course requires the students to identify and analyse natural and human- made environmental problems, evaluate the relative risks associated with these problems, and examine alternative solutions for resolving or preventing them. This course will survey some of the many environmental science topics at an introductory level, ultimately considering the sustainability of human activities on the planet. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa.

COURSE OBJECTIVES:
- To recognize the impacts of human interventions towards environment
- To list out the benefits in creating a sustainable environment
- To sketch out various activities in achieving a cleaner environment
- To emphasize the role of an individual for a better planet to live

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Gain a variety of experiences & acquire a basic knowledge about the environment & its allied problems
CO-2: Interpret the key components in safe guarding the environment
CO-3: Appraise the quality of environment in order to create a healthy atmosphere
CO-4: Familiarize with the individual responsibilities towards green revolution

MODULE 1: INTRODUCTION
Environmental Science: Introduction, Definition, scope and importance.

MODULE 2: AWARENESS ACTIVITIES
Small group meetings about:
- Water management
- Projects Vs Environment
- Generation of less waste
- Promotion of recycle use
- Impact of Science & Technology on Environment
- Avoiding electronic waste

MODULE 3: SLOGAN AND POSTER MAKING EVENT
- Food waste management
- Rain water harvesting

- Climate change
- Green Power
- Water conservation
- Green at work
- Role of IT in environment and human health
- Sustainable development

MODULE 4: EXPERT LECTURES ON ENVIRONMENTAL SCIENCE
- Environmental Impact Assessment
- Industrial waste treatment
- Organic farming/Vertical gardens/Hydroponics

MODULE 5: CLEANLINESS DRIVE
- Indoor air pollution
- Vehicular pollution
- VISUAL pollution
- Waste management at home
- Composting
- Plastic recycling

MODULE 6: CASE STUDIES
- HPCL disaster in Vizag
- Oleum gas leak in Delhi
- Mathura Refinery & Taj Mahal
- Conservation of Hussain Sagar lake
- The Cleanliest city of India-Surat
- Green Buildings in India
- KBR park in Hyderabad (Environmental protection Vs Development)
- Fluorosis
- Ecotourism & its impacts

TEXT BOOKS:
1. Environmental Studies for UG Courses, Erach Bharucha, UGC Publications, Delhi, 2004
2. Textbook of Environmental Studies, Deeksha Dave, S. S. Katewa, Cengage Delmar Learning India Pvt., 2012

REFERENCES:
1. Introduction to Environmental Science, Y. Anjaneyulu, BS Publications, 2004
2. Environmental Studies by Anubha Kaushik & C. P. Kaushik, 4th Edition, New Age International Publishers